**DO NOT OPEN THIS TEST BOOKLET TILL YOU ARE ASKED TO DO SO.**

**TR/TES/E-I/DEG/16**

Test Booklet Series

# TEST BOOKLET
# ELECTRICAL ENGINEERING PAPER–I
# (DEGREE)

**A**

2017.02

(Signature of the Candidate)

(Invigilator's Signature)



**Time Allowed : 3 hours (Three hours)** **Maximum Marks : 200**

## INSTRUCTIONS

1. IMMEDIATELY AFTER THE COMMENCEMENT OF THE EXAMINATION, YOU SHOULD CHECK THAT THIS TEST BOOKLET DOES NOT HAVE ANY UNPRINTED OR TORN OR MISSING PAGES OR ITEMS ETC. IF SO, GET IT REPLACED BY TEST BOOKLET OF SAME SERIES.

2. **ENCODE CLEARLY THE TEST BOOKLET SERIES IN THE APPROPRIATE PLACE IN THE ANSWER SHEET BY BLACK BALL POINT PEN ONLY.**

3. This Test Booklet is divided into three sections, i.e **Section-A, Section-B & Section-C.**

   (A) **Section-A (MCQ pattern)** contains 40 items (questions). Each question, carrying 2 (two) marks only, has four responses (answers). You will select the response which you want to mark on the **OMR Sheet.** In case you feel that there is more than one correct response, mark the response which you consider the most appropriate. In any case, choose ONLY ONE response for each item. There shall be no negative marking for wrong/multiple answer.

   (B) Questions under **Section-B (Conventional Method) & Section-C (Conventional Method)** are to be answered in separate **answer book.**

4. You have to mark all your responses of **Section-A by Black Ball Point Pen only** on the separate OMR Answer Sheet provided. See directions in the Answer Sheet.

5. Before you proceed to answer the responses to various items in the Test Booklet, you have to fill in some particulars both in the Answer Sheet for Section-A and in the Answer Book for Section-B & Section-C.

6. On completion of the examination, you should hand over the OMR Answer Sheet for Section-A & Answer Book for Section-B & C to the Invigilator only. You are permitted to take the Test Booklet with you.

7. Sheets for rough work are appended on the Test Booklet at the end.

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The figures in the margin indicate full marks for the questions.
Symbols have their conventional meaning.

## SECTION – A

40×2=80

Answer *all* questions. Each question carries two marks. Each question has four alternative answers. Select the correct answer and mark on the OMR sheet.

Example : KWh is the unit of

(A) Energy

(B) Power

(C) Electric charge

(D) Electric current

1. Conductivity is measured in terms of

(A) Ohm / metre

(B) Ohm / metre$^2$

(C) mhos / metre

(D) mhos / metre$^2$



2. Poynting vector has the unit of

(A) Watt

(B) Watt / metre

(C) Watt / metre$^2$

(D) Newton

3. Magnetic field inside a current carrying solenoid is

(A) directly proportional to current

(B) directly proportional to its length

(C) inversely proportional to numbers of turns

(D) inversely proportional to current

4. A magnetic needle is kept inclined in a uniform magnetic field. It experiences :

(A) a force and a torque

(B) a force but not a torque

(C) a torque but not a force

(D) neither a torque nor a force

5. The EM field and current are concentrated close to the surface of the conductor. The phenomenon is called

(A) Faraday's effect

(B) Skin effect

(C) EM concentration effect

(D) Ohm's effect

6. A time varying magnetic field produces

(A) magnetic field only

(B) electric field only

(C) both magnetic and electric fields

(D) none of these

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7. $\vec{\nabla} \times \vec{H} = D + J$ is

(A) Continuity equation

(B) Maxwell's equation

(C) Poisson's equation

(D) Laplacian equation

8. Which material has the highest electrical conductivity ?

(A) Steel

(B) Silver

(C) Aluminium

(D) Lead



9. Dielectric constant for vacuum is

(A) infinity

(B) 100

(C) 1

(D) zero

10. When a ferromagnetic substance is magnetised, small changes in dimensions occurs which is known as —

(A) magnetic hysteresis

(B) magnetic expansion

(C) magnetostriction

(D) magneto-calorisation

11. A material with unequal anti-parallel atomic magnetic moment is

(A) an anti-ferromagnet

(B) ferrimagnet

(C) a ferrite

(D) non-magnetic



12. Constantan is an alloy of

(A) copper and lead

(B) copper and nickel

(C) copper and aluminium

(D) copper and zinc

13. The effect of moisture in the insulating material is

(A) to increase insulation resistance

(B) to increase dielectric strength

(C) to increase dielectric loss

(D) to decrease dielectric constant

14. Super conductors are popularly used for

(A) generating very strong magnetic field

(B) reducing $I^2R$ losses

(C) generating electrostatic field

(D) generating regions free from magnetic field

15. The unit of retentivity is

(A) Weber

(B) Weber-metre

(C) Weber per metre

(D) Weber per square metre

16. Which of the following effects is mainly observed when two junctions of a thermocouple are kept at different temperatures ?

(A) Thomson effect

(B) Seeback effect

(C) Peltier effect

(D) Joule effect



17. An ideal current source has zero

(A) internal conductance

(B) internal resistance

(C) voltage on no-load

(D) ripple

18. A network which contains one or more than one source of emf is known as

(A) active network

(B) passive network

(C) electric network

(D) non-linear network

19. Electrical appliances are connected in parallel because it

(A) is a simple circuit

(B) draws less current

(C) results in reduced power loss

(D) makes the operation of appliances independent of each other



20. Kirchhoff's voltage law deals with

(A) Conservation of energy

(B) Conservation of charge

(C) Conservation of momentum

(D) Conservation of angular momentum

21. Under the condition of maximum power transfers, a voltage source is delivering a power of 30W to the load. The power generated by the source is

(A) 45W

(B) 30W

(C) 60W

(D) 90W

22. If one cycle of a.c. waveform occurs every milliseconds, the frequency will be

(A) $\frac{1}{1000}$ Hz

(B) 50 Hz

(C) 100 Hz

(D) 1000 Hz

23. When two 2-port networks are connected in parallel, it is convenient to use

(A) Z parameters

(B) Y parameters

(C) h parameters

(D) inverse h parameters

24. A pointer of an instrument once deflected returns to zero position, when the current is removed, due to

(A) action of gravity

(B) mass of the pointer

(C) controlling torque

(D) damping torque

25. Maxwell bridge is used to measure

(A) resistance

(B) inductance

(C) capacitance

(D) frequency



26. Which of the following instruments will be suitable for the measurement of temperature of a furnace ?

(A) Clinical thermometer

(B) Mercury thermometer

(C) Optical pyrometer

(D) Bimetallic thermometer

27. A strain gauge has a

(A) piezo electric effect

(B) piezo resistive effect

(C) piezo capacitive effect

(D) piezo inductive effect



28. In two wattmeter method, the power factor angle is given by

(A) $\theta = \tan^{-1} \frac{\sqrt{3}\,(W_1 - W_2)}{(W_1 + W_2)}$

(B) $\theta = \cos^{-1} \frac{\sqrt{3}\,(W_1 - W_2)}{(W_1 + W_2)}$

(C) $\theta = \tan^{-1} \frac{\sqrt{3}\,(W_1 + W_2)}{(W_1 - W_2)}$

(D) $\theta = \cos^{-1} \frac{\sqrt{3}\,(W_1 + W_2)}{(W_1 - W_2)}$

29. Permanent magnets used in instruments are generally made of

(A) cast iron

(B) stainless steel

(C) alnico

D) y-alloy

30. Which voltmeter has the least power consumption ?

(A) induction type

(B) hotwire type

(C) electrostatic type

(D) moving iron attraction type

31. Piezoelectric transducers are

(A) active transducers

(B) passive transducers

(C) secondary transducers

(D) none of these

32. A thermistor has

(A) high and negative temperature coefficient of resistance

(B) low and negative temperature coefficient of resistance

(C) high and positive temperature coefficient of resistance

(D) low and positive temperature coefficient of resistance.

33. What output voltage would be produced by a D/A converter whose output range is 0 to 10V and whose input binary number is 10 ?

(A) 5V

(B) 10V

(C) 15V

(D) 20V



34. In force-voltage analogy, moment of inertia is analogous to

(A) capacitance

(B) inverse capacitance

(C) inductance

(D) inverse inductance

35. Signal flow graph is a

(A) Semilog graph

(B) log log graph

(C) topological representation of a set of differential equations

(D) a special type of graph for analysis of modern control system



36. Nichols chart is useful in determining

(A) closed loop frequency response only

(B) open loop frequency response only

(C) open loop and closed loop frequency response

(D) none of these

37. Presence of non-linearities in a control system tends to introduce

(A) transient error

(B) instability

(C) steady state error

(D) all of these

38. If a system has some poles lying on the imaginary axis, it is

(A) unconditionally stable

(B) conditionally stable

(C) marginally stable

(D) unstable

[Turn over

39. Which of the following directly converts temperature into voltage ?

(A) Gear train

(B) Potentiometer

(C) Thermocouple

(D) LVDT



40. Pressure error can be measured by

(A) strain gauge

(B) selsyn

(C) differential bellows and strain gauge

(D) strain gauge and potentiometers.



15×6=90

## SECTION - B

Answer *all* questions. Each question carries six marks, answer is to be restricted to 40 words.

1. State the superposition theorem.
2. Differentiate between active network and passive network.
3. Define rise time and settling time in transient response characteristics.
4. What are the desirable properties for insulating materials ?
5. What are super-conductors ?
6. Define diamagnetic, paramagnetic and ferromagnetic materials in terms of permeability.
7. Define intrinsic and extrinsic semiconductors.
8. List the various A/D conversion techniques.
9. State Gauss law. What is electric field intensity ?
10. Describe the spring control method for providing controlling torque in indicating instruments.
11. What are the characteristics of feedback in closed loop control system ?
12. What is signal flow graph ?
13. What are the advantages in thermistor as a temperature transducer ?

14. What are the advantages of three phase system over single phase power system ?

15. What is maximum power transfer theorem ?

## SECTION - C

5×6=30

Answer *all* questions. Each question carries six marks.



1. Three coils, each having a resistance of 20Ω and an inductive reactance of 15Ω are connected in star to a 400V, 3-phase, 50 Hz supply.

   Calculate

   (i) the line current

   (ii) power factor and

   (iii) power supplied.



2. Derive the open-circuit impedance parameters of two port network.

3. A current varying with time as $i = i_o t$ flows through an inductance L. Find the voltage across the inductor as a function of time. How much charge flows in time $t_o$ ?

4. A closed loop control system has the characteristic equation given by
   $S^3 + 4.5\ S^2 + 3.5\ S + 1.5 = 0$
   Investigate the stability using Routh-Hurwitz criterion.

5. A 230V, 50 Hz a.c. supply is applied to a coil of 0.06H inductance and 2.5Ω resistance, connected in series with a 6.8 μF capacitor. Calculate

   (i) impedance

   (ii) current

   (iii) phase angle between current and voltage

   (iv) power factor and

   (v) power consumed.

*(Space for Rough work)*